SEEDING RATES AND ROW SPACING FOR FORAGE CROPS IN SOUTHWESTERN SASKATCHEWAN

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The origin of the formerly recommended seeding rate for forages in Saskatchewan is lost in the mists of antiquity but probably is derived in part from experiments carried out at Swift Current in the 1930's with crested wheatgrass. Rates of 5, 10, 15 and 20 lbs of seed per acre were seeded in 6-inch rows and it was found that the lowest rate of 5 lbs per acre produced as good a yield as the higher rates. However, to compensate for variable seed quality and seeding technique, a seeding rate of 10 lbs per acre was recommended. This is equivalent to a seeding rate of 30 seeds per row foot or 100 seeds per row metre and has remained the basis for our seeding rate recommendations ever since.

Since the 1930's, however, forage varieties have been greatly improved and better seedling vigor has been bred in. Also, tougher seed quality controls have ensured more uniformity and higher germination rates. Seeding techniques have also improved and the concept of wider rows has been accepted for the semiarid climate of the prairies since it has been shown by Kilcher (1972) that a reduced grass stand yields better as there is less interplant competition for water.

For these reasons it was considered that the existing recommended rate of 100 seeds per row metre was too high and an experiment was designed to determine whether a lower seeding rate of three varieties, either alone or in alternate rows, at three row spacings would produce as much as the higher recommended rate.

METHODS

In spring of 1974, four rows each of alfalfa (*Medicago media* Pers. cv. Drylander), Russian wild ryegrass (*Elymus junceus* Fisch. cv. Mayak), and crested wheatgrass (*Agropyron desertorum* (Fisch.) Schult. cv. Summit) were seeded either alone or in alternate grass-alfalfa rows at six seeding rates of 17, 33, 50, 67, 83 and 100 seeds per metre row and in three row spacings of 30, 60 and 90 cms. The treatments were arranged in a 4-replicate, split-split plot design with spacings as the main plot, plant species as the subplot, and seeding rates as the sub-subplot.

There was no cut taken in the establishment year. Following this establishment year one cut was taken in late June and in subsequent years two cuts were taken, the first in early June when the alfalfa was in one-tenth flower and the second in late July when the alfalfa regrowth was in mid-flower.

The effects of the three factors, seeding rate, row spacings and crops, were examined for each year using analysis of variance and difference between means were tested using Duncan's multiple range test (Steel

and Torrie 1960).

RESULTS AND DISCUSSION

In the first harvest year, the response of the alfalfa, the alfalfa-grass mixtures, or the grasses to the various seeding rates was the same at all three row spacings (Fig. 1). It is clear that even in this first year, seeding at the recommended rate of 100 seeds/metre row produced little yield advantage over seeding at rates of 67 and 83 seeds/metre row although the seeding at lower rates does produce poorer yields.

By the second year of harvest, differences between the responses of crops to the seeding rates were beginning to appear. These responses were the same at all three row spacings. The two grasses, when grown alone, produced similar yields at all seeding rates, indicating that even by the second year of harvest, there was little yield advantage to be gained from seeding at the higher rate. For pure alfalfa, too, there was little difference in yield between the plots seeded at a rate of 100 seeds/metre row and the plots seeded at a rate of 100 seeds/metre row and the plots seeded at lower rates down to 33 seeds/metre row. However, at the lowest rate of 17 seeds/metre row, there was a sharp decline in yield.

The responses of the alternate grass-alfalfa rows were more curvilinear than the pure stands, however, there was no significant difference between the yields of the plots seeded at 100 seeds/metre and the plots seeded at 33 seeds/metre.

The curvilinear relationship between seeding rates and the alternate grass-alfalfa seen in the second harvest year had disappeared by the third harvest year. In this year, all five crop combinations had a linear response to seeding rate. Only at the 90-cm spacing were yields affected by the original plant populations and that effect only occurred in the first cut. Similar yields were obtained from the pure alfalfa and the alternate alfalfa-grass combinations with the pure grass stands yielding considerably less.

In subsequent years there was very little difference between the yields at the various seeding rates. One item of note is that the yields of the crop in alternate rows became greater than the yield of alfalfa alone. This rather anomalous result requires further investigation but may be the result of declining deep moisture and/or nutrient supply. The declining of the yields over the years reflects the harshness of the cutting regime which may also be implicated in the anomalous results.

Row spacings had a considerable effect upon dry matter yield (Fig. 2). In the first harvest year, the yields of all crops except Russian wild ryegrass were substantially higher when grown in 30-cm row spacings. By the second year, both grasses were showing a greater yield response to the wider row spacings although the alfalfa still produced more in narrow rows, probably because of the continued exploitation of deeper moisture.

By the third year the wider rows were beginning to show advantages for alfalfa yield. During the subsequent two years the transition in yield advantage continued through the 60-cm rows to the 90-cm rows.

Due to this transition of highest yield from the 30-cm row spacing to the 90-cm row spacing, the mean annual yield for the first five years shows little yield advantages to seeding alfalfa or alternate alfalfa-grass rows in wide spacings. However, it is unlikely that dryland would be seeded for only five years. It is anticipated that the mean annual yield for the second 5-year period would show a distinct yield advantage to the 90-cm spacing since the stand dynamics have now approached equilibrium. It is worth noting that the grasses after the first year always yielded better in the wider rows.

It is clear, therefore, that under the semiarid climate of southwestern Saskatchewan, high seeding rates only confer a yield advantage during the early stages of a forage crop establishment. The concept that there is only enough moisture and nutrients available for a limited number of plants as expounded by Kilcher that led to the adoption of wide row spacings as a general agronomic practice in southwestern Saskatchewan evidently applied to within row populations. Excessive seeding rates may produce more seedlings but many will not survive to maturity and the yield of the remainder is restricted by interplant competition. These data tend to suggest that the optimum plant density for a maximum yield in a stable population would be less than 19 plants per square metre.

Thus, it must be concluded that using certified seed and modern seeding techniques, the quantity of seed needed to establish a forage crop can be greatly reduced. However, it is unlikely that the lowest seeding rate of 17 seeds/metre is at present a practical reality primarily because of the problems in adjusting the seeding machinery to evenly distribute seed at this low rate but also because of the delay in attaining maximum yields. A more realistic rate would probably be in the area of 50 to 60 seeds/metre, a seeding rate that can be accomplished especially if the seed is diluted with fertilizer or cracked cereal, and a seeding rate that will give as high a yield in the first year as the heavier seeding rates. As a result of this study, the Saskatchewan Advisory Council on Forage Crops is now recommending seeding rates based upon 60 seeds per metre of row length.

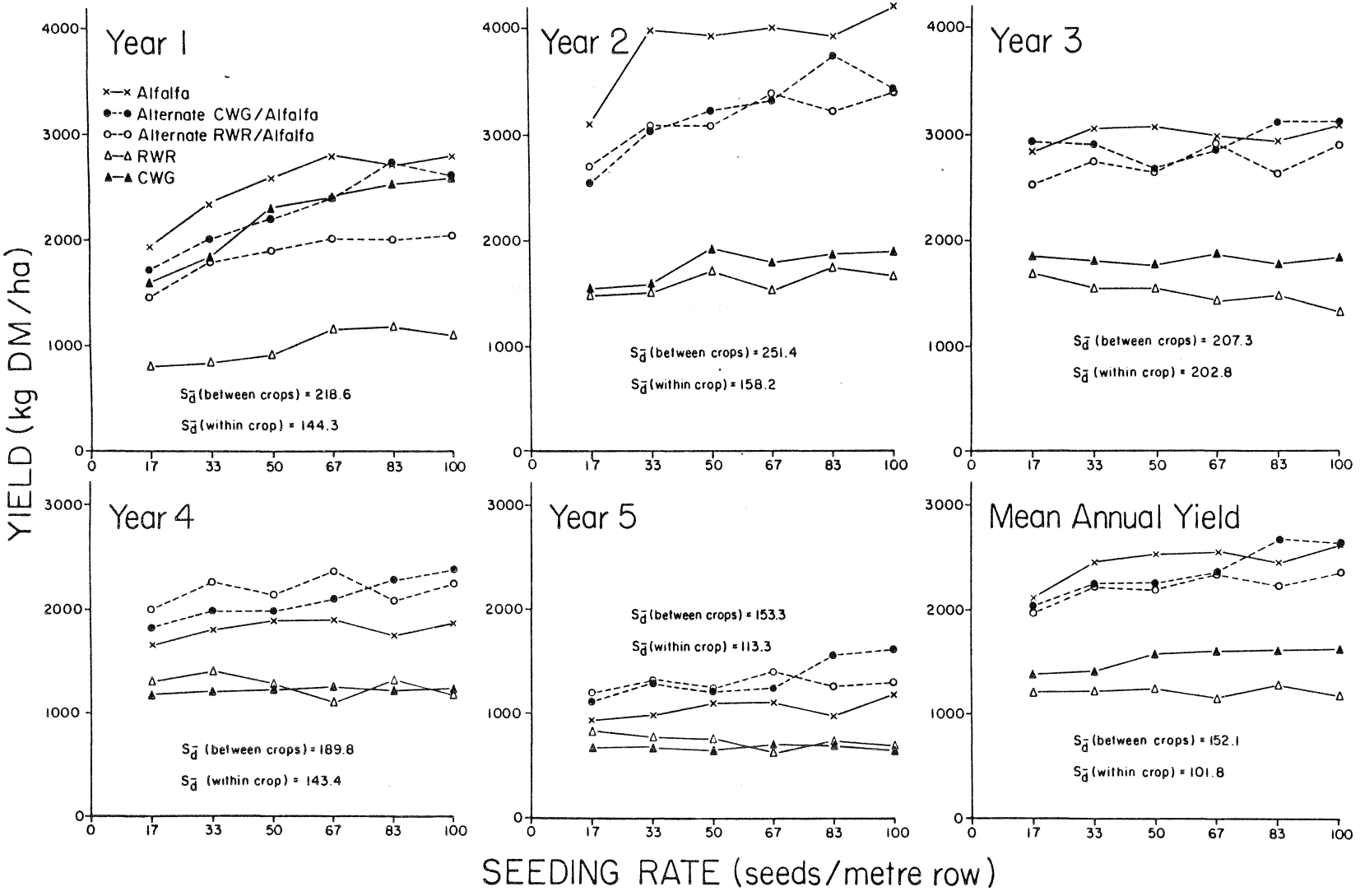

Fig. 1. Effect of seeding rate on yield over first five years of harvest

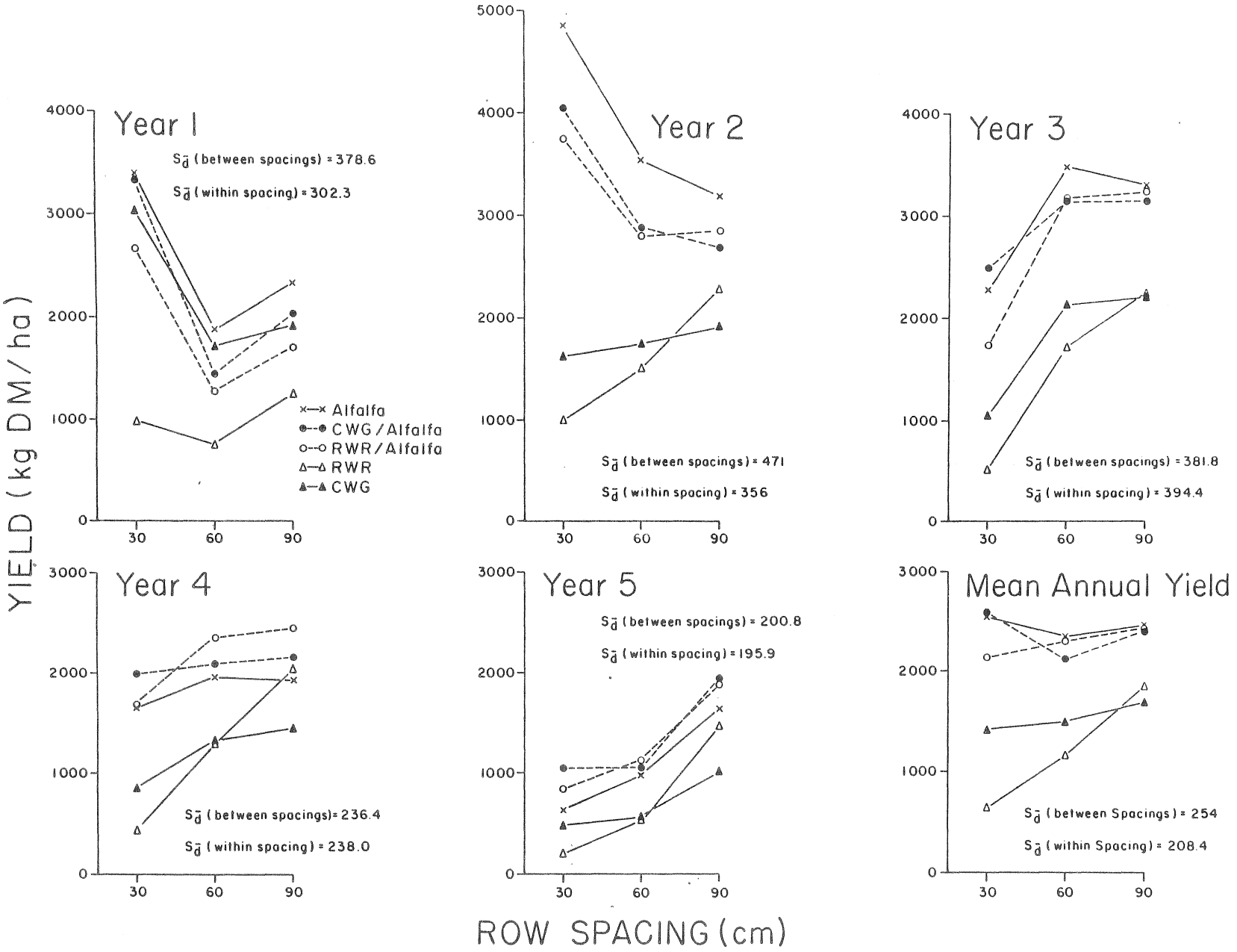

Fig. 2. Effect of row spacing on yield over first five years of harvest